



Dart Aerospace Ltd.
1270 Aberdeen St
Hawkesbury, ON
K6A 1K7
Canada

Tel (613) 632-5200

7

D350-748-241TRN
Job Sheet 174757



Part No: D350-748-241TRN

Job Qty: 1 ea

Part Name: Crosstube Turning Detail



Part Weight: 0 lbs

Status: Scheduled

Priority: Medium

Job Created: 3/21/18

Job Tracking No:

Due Date: 6/1/18

Created By: Marie Lajeunesse

Type: SOLD

Description:

Note: D350-748-241 REV H IPP Rev:A New Issue 08-03-06 DD verified by:ec IPP Rev B Removed polish 08.04.02
EC verified by : DD IPP Rev C Removed LPS-3 08.06.23 Ec verified by: DD IPP Rev D 11.02.24 as per dwg
rev.F DD verf: JLM

Ship Via:

Bill of Materials

Job Routing

Op No	Operation	Qty	Start Date	Due Date	Standard		Workcenter/Supplier		Sign-off
					Setup hrs	Run Hrs	Workcenter / Supplier	Lead Time	
90	Start up Operation	1 Ea		5/31/18	0.00	0.00	Start Up Crosstubes-1		M.D
100	Mori Seiki	1 pcs		5/31/18	7.06	2.81	Mori Seiki TL-40		M.D
110	QC	1 pcs		5/31/18	0.00	0.00	QC2-1		M.D
120	Mori Seiki	1 pcs		5/31/18	0.00	2.81	Mori Seiki TL-40		M.D
130	QC	1 pcs		5/31/18	0.00	0.00	QC2-1		M.D
140	QC	1 pcs		5/31/18	0.00	0.00	QC8		M.D
150	Crosstubes	1 pcs		6/1/18	0.00	0.97	Crosstubes-2		SPH 18-05-31
160	QC	1 pcs		6/1/18	0.00	0.00	QC15 N/R		CT 18-6-5
170	Outsource	1 pcs		6/1/18	0.00	0.00	Outsource1		AT 18/07/11
180	Packaging	1 pcs		6/1/18	0.00	0.00	Packaging2		AT 18/07/11
185	QC	1 pcs		6/1/18	0.00	0.00	QC6		D 18-07-12
190	Packaging	1 pcs		6/1/18	0.00	0.00	Packaging3-1		D 18-07-13
200	QC21-SA	1 Ea		6/1/18	0.00	0.00	QC21		21 JUL 17 2018

Part Op 100 - 1-Fill tube with sand & install plugs on both ends as per Folio FA647 2-Turn first side as per Folio FA647 3- File
Descriptions: transition lines smooth. FOLIO REV: H DWG REV: H

120 - 1-Turn second side as per Folio FA647 2- File transition lines smooth. 3-Scribe part # as per Dwg D350-748-241

FOLIO REV: H DWG REV: H

130 - PERFORME ULTRASONIC MEASURMENT

150 - 1-DRILL HOLES FOR HEAT TREAT USING DT9806(HOLES MUST BE ALIGNED ON SAME LINE ON BOTH CUFFS) 2-Grind machining marks

170 - Issue P/O: 040105 Heat Treat to min 180 KSI As per Dwg D350-748-241 ***Check for straighten and ensure parts are straight within 1/8" as per dwg *** Sand Blast tube after Heat Treat Possible Supplier: Vac Aero Ensure Certificate of Conformity is attached and Metlab process spec form

190 - Identify and stock in kanban rack

Job BOM

Part / Item	Component Name	Quantity	Operation	Container
D6015-125	Crosstube Material	1 Ea (1 ea)	90-Start up Operation	
B128 725				

Job Allocations

Operation	Component Part	Required	Inventory	Allocated
90-Start up Operation	D6015-125	1	0	0

DQA: _____ Date: _____

**WORK ORDER NON-CONFORMANCE / UPDATE**

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____	DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐	AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐																																																												
Date : _____	Step #: _____	QTY Effective : _____		MRB (QSI042) Approval																																																										
Description Work Order Deviation			Disposition																																																											
DART AEROSPACE Container No: S071752 Part: D350-748-241TRN Job No: 174757 Serial No/Batch: S071752 Revision: H Inspector: _____ Date: 05/16/18			Completed By																																																											
			Lead hand / Supervisor Approval Verification																																																											
			QC / QA Coordinator Approval																																																											
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OTHER : _____																																																														

Part Specifications

Specifications could not be found.

Plex 3/21/18 10:14 AM Dart.lajeunesse.marie

DQA: _____ Date: _____



WORK ORDER NON-CONFORMANCE / UPDATE

QA Closed: _____ Date: _____

Work Order update only ☐

Work Order: _____ Part No. _____ NCR No. _____		DISPOSITION Rework ☐ Scrap ☐ Use-as-is ☐ Suspected Unapproved ☐		AGAINST DEPARTMENT/PROCESS Skid-tube ☐ Machining ☐ Thermoforming ☐ Large Fab ☐ Cross tube ☐ Small Fab ☐ Finishing ☐ Composite ☐ Water Jet ☐ Prod. Eng. Coord. ☐ Rec/Store/Packaging ☐ Supplier ☐ Engineering ☐ Quality ☐ Other ☐					
Date :		Step #:		QTY Effective :			MRB (QSI042) Approval Completed By Lead hand / Supervisor Approval Verification QC / QA Coordinator Approval		
Description Work Order Deviation				Disposition					
Root Cause		FAULT CATEGORY							
Environment ☐	No Re-verification ☐	Pressure/Forced ☐	Temperature/Cure ☐	Power Loss/Surge ☐	Positioned Wrong ☐				
Design ☐	Operator ☐	Bending ☐	Set-up ☐	Folio/Program ☐	Outside Dimensions ☐				
Doc/Data ☐	Offset/Setup ☐	Centre Not Concentric ☐	BOM/Route ☐	Grain ☐	Over/Under tolerance ☐				
Equip/Tooling ☐	Supplier ☐	Cracks ☐	Broken/Damage/Defect ☐	Weld ☐	Part Incorrect ☐				
Handling/Pre ☐	Training ☐	Crimp/Kink/Ripple/Wave ☐	Inspection Incomplete/Unqualified ☐	Wrong Stock Pulled ☐	Part Lost/Missing ☐				
Material ☐	Use for Testing ☐	Cuffs ☐	Contamination ☐	Out of Sequence ☐	Part Moved ☐				
Internal Transport ☐	Poor Information ☐	Crushing ☐	Countersink ☐	Off-set ☐	Drawing ☐				
Tribal Knowledge ☐	Rushing ☐	Heat Treat ☐	Cut Too Short ☐	Mislabeled ☐	Finish ☐				
LOA ☐	Product Improvement ☐	Wave/Twist in Tube ☐	Instructions Incomplete/Unclear ☐	Fit/Function ☐	Misread ☐				
Substation ☐	Process Improvement ☐	Marks/Chatter ☐	Drill Holes ☐	Misaligned/off center ☐	Turning Sequence ☐				
Past Expiry Date ☐	Manufacturing Process ☐	OTHER : _____							
Misidentified ☐	Past Due ☐								

⑦

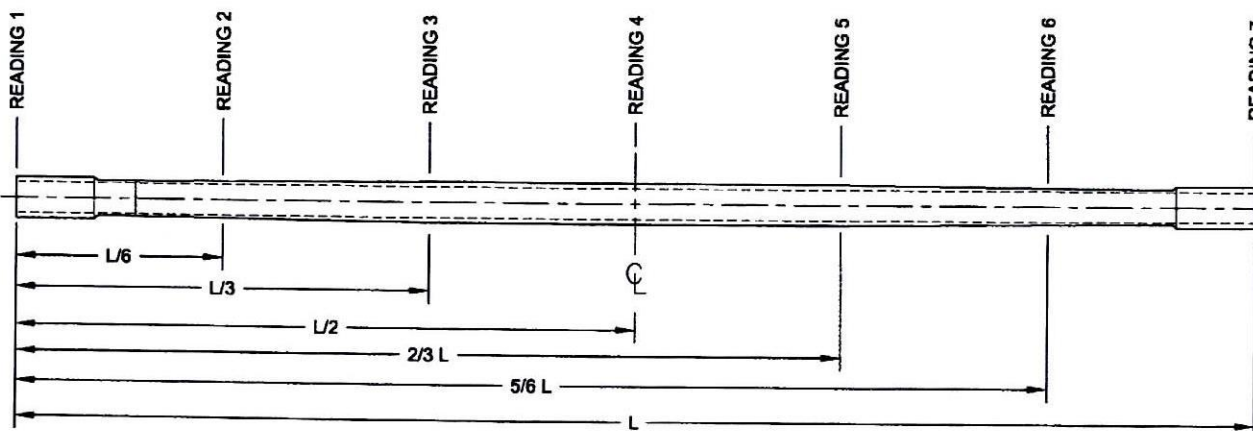
DART AEROSPACE LTD		Work Order:	174757
Description: Crosstube Assembly (AS350/355 High Aft)		Part Number:	D350-748-241
Inspection Dwg: D350-748-241 Rev: H		Page 1 of 2	

FIRST ARTICLE INSPECTION CHECKLIST

Inspection Sheet	Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+/-0.005	2.242	✓		BLM3"04	
	2.180	+0.005/-0.000	2.182	✓			
	2.180	+0.005/-0.000	2.182	✓			
	2.208	+0.005/-0.000	2.210	✓			
	2.234	+0.005/-0.000	2.236	✓			
	2.253	+0.005/-0.000	2.255	✓			
	2.272	+0.005/-0.000	2.277	✓		BLM3"04	
	2.299	+0.005/-0.000	2.302	✓		Vern 08	
	0.063	+/-0.010	.063	✓		RG	
	5.25	+/-0.060	5.240	✓		Vern 08	
	R0.063	+/-0.010	.063	✓		RG	
	R0.50	+/-0.030	.500	✓		RG	
SIDE B	2.240	+/-0.005	2.2435	✓		BLM3"04	
	2.180	+0.005/-0.000	2.185	✓			
	2.180	+0.005/-0.000	2.185	✓			
	2.208	+0.005/-0.000	2.213	✓			
	2.234	+0.005/-0.000	2.239	✓			
	2.253	+0.005/-0.000	2.2575	✓			
	2.272	+0.005/-0.000	2.2765	✓		BLM3"04	
	2.299	+0.005/-0.000	2.303	✓		Vern 08	
	0.063	+/-0.010	.063	✓		RG	
	5.25	+/-0.060	5.240	✓		Vern 08	
	R0.063	+/-0.010	.063	✓		RG	
	R0.50	+/-0.030	.500	✓		RG	
	124.70	+/-0.060	124.70	✓		Tape	

DART AEROSPACE LTD		Work Order:	174757
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WALL THICKNESS MEASUREMENT



Location	WALL THICKNESS MEASUREMENT (IN)				Deviation Δw (max-min)	TOLERANCE
	w1	w2	w3	w4		
READING 1 L= 0"	.116	.111	.114	.118	.007	0.030"
READING 2 L= 20.78	.102	.102	.110	.112	.010	
READING 3 L= 41.57	.149	.145	.142	.147	.007	
READING 4 L= 62.35	.141	.143	.154	.155	.014	
READING 5 L= 83.13	.142	.148	.152	.148	.010	
READING 6 L= 103.92	.111	.110	.105	.105	.006	
READING 7 L= 124.70	.128	.113	.105	.119	.023	

Calibration Result

Actual Block Thickness: 100-200

Sitescan 250 Measured Thickness: 100-200

Measured by:	M.D
Date:	2018-05-15

Audited by:	[Signature]
Date:	18-05-25

Preliminary Approval:	
Date:	

Rev	Date	Change	Revised by	Approved
C	12.06.04	Wall thickness form added (P/O D350-748-201)	KJ	
D	13.02.27	Dimension 5.25 was 4.26	KJ	
E	14.04.25	122.70 dimension revised to 124.70	KJ	
F	15.04.14	Dwg Rev updated	KJ	
G	15.09.09	Tolerance updated for dimension 2.240	KJ	

Item	Qty -241	Part Number	Description
1	X	D350-748-241	CROSSTUBE ASSEMBLY (AS 350/355 HI AFT)
2	1	D6015-125	CROSSTUBE (OR D6018-125)
3	2	D3502-1	SUPPORT
4	2	D5123-7	CLAMP CUSHION
5	1	AELS-1032-225	INSERT
6	1	NAS1149D0363J	WASHER (OR AN980JD10)
7	2	MS21920-20	CLAMP (OR MS21920-21/-22, PER DART SPEC. M-MS21920-21/-22)
8	1	MS27039-1-10	SCREW
9	A/R	PROSEAL 890 B-2	SEALANT, AMS-S-8802 CLASS B-2

GENERAL NOTES:

- MATERIAL: MANUFACTURED FROM D6015-125 OR D6018-125
FINISHED LENGTH AFTER TURNING = 124.70±0.06 (AFTER BENDING/TRIMMING = 122.70 REF)
- FINISH: MAGNETIC PARTICLE INSPECT PER DART QSI 038 4.2
CADMIUM PLATE PER AMS-QQ-P-416B, CLASS 1, TYPE II
PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2
PAINT OUTSIDE PER DART QSI 005 4.2
- TOLERANCE: PER DART QSI 018 UNLESS OTHERWISE NOTED.
WALL THICKNESS ECCENTRICITY PER DART QSI 038 7.2
MIN. ALLOWABLE WALL IS -0.020 FROM NOMINAL
- UNITS: INCHES UNLESS OTHERWISE NOTED.
- BREAK SHARP EDGES: 0.005 TO 0.010 MAX.
- IDENTIFICATION: DART PART NUMBER "D350-748-241" AND BATCH NUMBER ON INSIDE OF CUFF
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- WEIGHT: 29.85 lbs
- PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.297 HOLE.
- EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES, NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY. CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO CRACKING/CHIPPING/GROOVES.

TURNING

- BLEND OUT ALL EDGES FROM MACHINING LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH. NOTE: ALL HOLES ARE DRILLED AFTER BENDING.
- HEAT TREAT TO MIN. 180 KSI PER MIL-T-6736 OR AMS2759/1E AFTER TURNING. ACCEPTABLE TO VERIFY TENSILE STRENGTH BY HARDNESS TEST PER ASTM E18 TO 40-45 HRC.

BENDING

- ALL DIMENSIONS FOR BENT TUBE ARE POST STRESS RELIEF
- BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES PER SIDE. MAXIMUM TUBE FLATTENING DUE TO BENDING IS 6% BASED ON O.D. ON TOP HALF OF BEND, AND 8% ON BOTTOM HALF OF BEND.
- MAX AMPLITUDE OF RIBBLING ALONG BENT PORTION OF THE TUBE IS 0.030 (ZN A1-3)
- AFTER BENDING, STRESS RELIEVE TUBE AT 650°F ±10.25°F FOR A MINIMUM OF 2 HRS AND ALLOW TO COOL TO AMBIENT TEMPERATURE (REF AMS2759/1E).
- MAX TWIST AFTER STRESS RELIEF: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.38 (ZN C1-3).

ASSEMBLY

- TO INSTALL D3502-1 SUPPORT: ABRASE MATING SURFACE OF SUPPORT AND CROSSTUBE WITH 180-GRIT SANDPAPER AND REMOVE RESIDUE WITH MEK (OR EQUIVALENT). APPLY A 0.02" TO 0.05" THICK LAYER OF PROSEAL 890 CLASS B-2 (OR AMS-S-8802 CLASS B-2) SEALANT TO MATING SURFACE OF SUPPORT.
- TORQUE CLAMPS 60 TO 80 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT NUT HAS NOT BOTTOMED-OUT AFTER TORQUING. PRIOR TO PACKAGING, RE-CHECK TORQUE ON CLAMPS AFTER PROSEAL 890 SEALANT HAS CURED FOR 72 HOURS.

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WORK ORDER

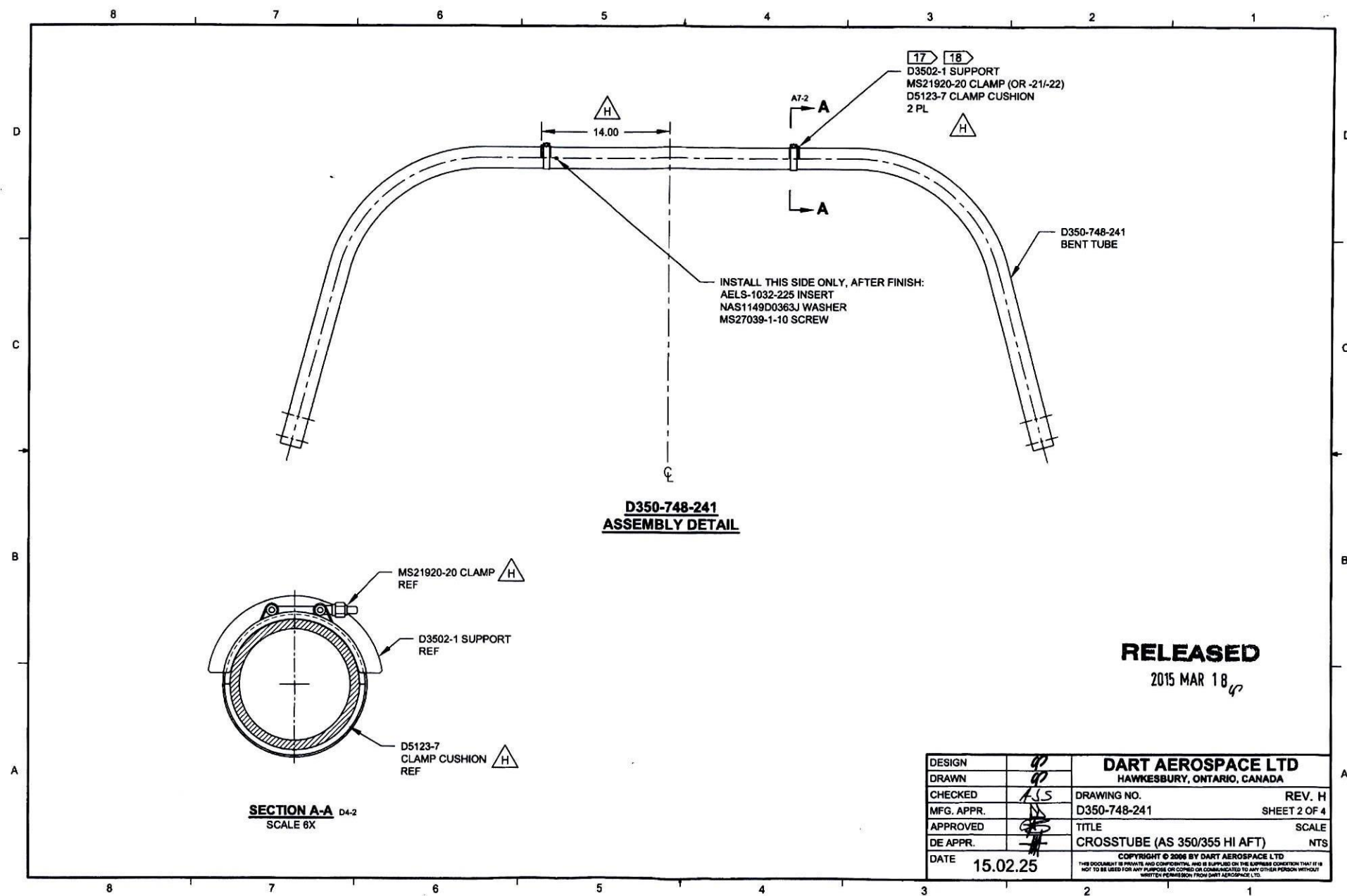
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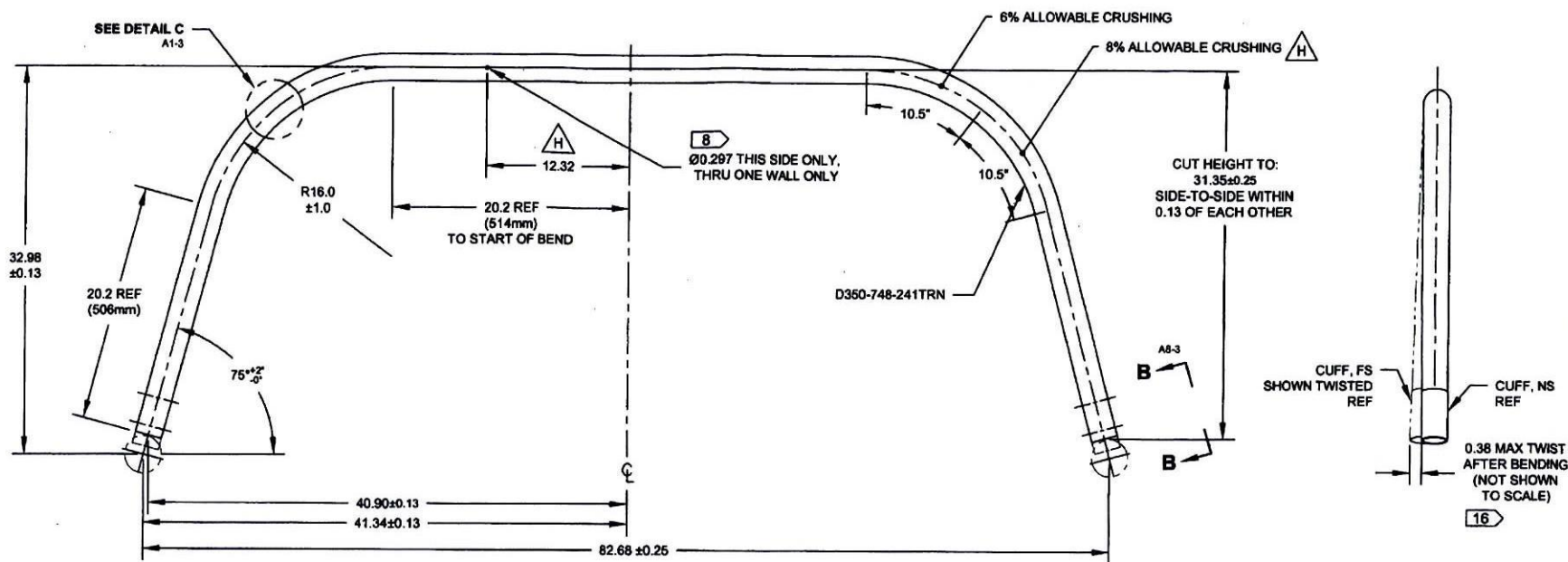
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2015 MAR 18

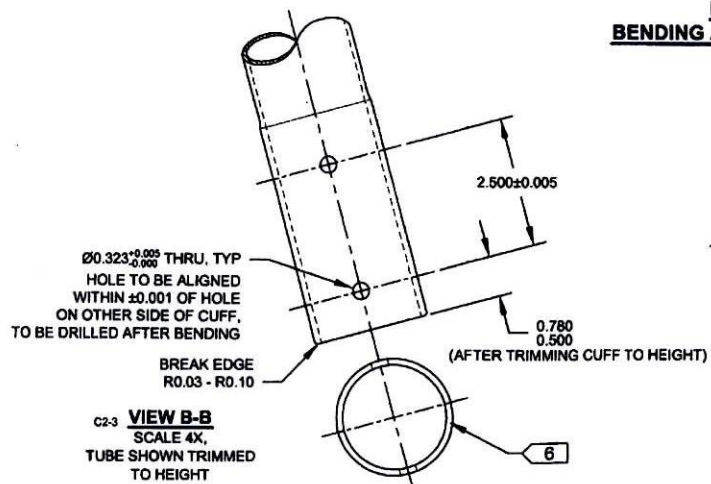
42 ECA 15-547

H	D5123-7 WAS D3595-063-395, MS21920-20 WAS -22, ALLOWABLE CRUSHING NOW 8% WAS 7%, 14.00 WAS 14.37 (D6-2), 12.32 WAS 12.69 (D6-3)	CP	15.02.25
G	RMV ABRASION STRIP, SUPPORT NOW W/ PROSEAL & CUSHION, ADD STRESS RELIEF, LONGER CUFF, NOW TRIM'D AFTER BEND, ADD WALL DIMS & UPDATE TOL.	CP	12.08.12
F	ADD HRC TEST OPTION (B6-1) PER PAR 09-040, ADD TWIST LIMIT (A8-1, C1-3), ADD D8015-125 OPTION (C8-1), STOCK DIM NOW MACHINED (D1-4)	CP	10.11.23
E	REVISE GENERAL NOTES; UPDATE TO CURRENT STANDARDS; RELOCATED FLAG #6 PER PAR 08-046 (ZN A8-3); ADD TOLERANCES (ZN C8-3, D2-3)	RF	09.09.30
D	MAG. PARTICLE AND CAD PLATE AS MFD.	CP	08.10.31
C	ADD CAD PLATING	CP	08.08.14
B	ADD D8018-125 & PRIME AND PAINT	CP	08.08.30
A	NEW ISSUE	CP	08.03.31
REV.	DESCRIPTION	BY	DATE
DESIGN		DART AEROSPACE LTD HAWKESBURY, ONTARIO, CANADA	
DRAWN			
CHECKED			
MFG. APPR.			
APPROVED			
DE APPR.		REV. H SHEET 1 OF 4	
DATE	15.02.25	SCALE NTS	
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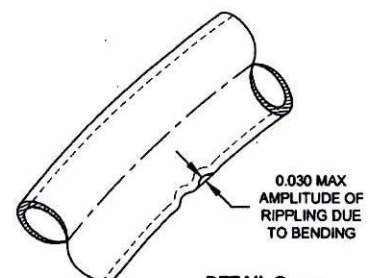




D350-748-241
BENDING AND DRILLING DETAIL 10



VIEW B-B
SCALE 4X,
TUBE SHOWN TRIMMED
TO HEIGHT



DETAIL C D7-3
SCALE 4X
RIPPLING EXAGGERATED

RELEASED
2015 MAR 18

DESIGN	<i>g</i>	DART AEROSPACE LTD	
DRAWN	<i>g</i>	HAWKESBURY, ONTARIO, CANADA	
CHECKED	<i>ASS</i>	DRAWING NO.	REV. H
MFG. APPR.		D350-748-241	SHEET 3 OF 4
APPROVED	<i>g</i>	TITLE	SCALE
DE APPR.	<i>g</i>	CROSSTUBE (AS 350/355 HI AFT)	NTS
DATE	15.02.25	COPYRIGHT © 2006 BY DART AEROSPACE LTD	
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Dart Aerospace Ltd.
1270 Aberdeen St
Hawkesbury, ON
K6A 1K7
Canada

Tel (613) 632-5200

PURCHASE ORDER **PO040105**

Supplier: MET002-VU
Metlab
1000 E. Mermaid Lane
Wyndmoor, PA 19038 USA
Phone: 215-233-2600
Fax: 215-233-5653

PO No: PO040105
PO Date: 6/5/18
Due Date: 6/20/18
Purchase Order
Revision:
Revision Date:
Ship-To Contact: Phone:

Ship To: 1270 Aberdeen Street
Hawkesbury
ON
K6A 1K7 Canada
Phone: 613-632-5200

Via: Ground
Pynt Terms: Net 30
Freight Terms:
Special Comments:

Items

Line Item	Job	Part	Description	Status	Due Date	Order Quantity	Received Quantity	Balance	Unit Price (USD)	Extended Price
1	174757	D350-748-241TRN	Crosstube Turning Detail Issue P/O: _____ Heat Treat to min 180 KSI As per Dwg D350-748-241 ***Check for straighten and ensure parts are straight within 1/8" as per dwg *** Sand Blast tube after Heat Treat Possible Supplier: Vac Aero Ensure Certificate of Conformity is attached and Metlab process spec form	Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174761			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174756			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174751			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174754			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174752			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174763			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174750			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174759			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174764			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174765			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174762			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174758			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174755			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
	174760			Firmed	6/20/18	1 pcs	0 pcs	1 pcs	\$205.00/pcs	\$205.00
Sub Total:						15	0	15		\$3,075.00



1000 E. Mermaid La., Wyndmoor (Phila.) PA 19038-8093
Tel. (215) 233-2600 Fax (215) 233-5653

Certification - R

SOLD TO

Dart Aerospace
1270 Aberdeen St.
Hawkesbury, ON K6A 1K7
Canada

July 11, 2018

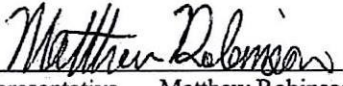
Metlab Shop Order:	100948
Purchase Order:	PO040105
Description:	Crosstube
Part Number:	D350-748-241TRN (15 Each) D350-748-141TRN (15 Each)
Weight:	1310 Pounds Total
Material:	4130 Alloy Steel
Specifications:	Harden and temper to 180 KSI minimum ultimate tensile strength (40 HRC surface hardness) per MIL-T-6736 or AMS 2759-1C. Maintain part straightness < 1/8" over total part length.

DAS
9
9.89

This is to certify that the above parts were processed as indicated above and conform to the specification requirements.

Results:

Hardness: 41/42 HRC

METLAB 
Quality Representative Matthew Robinson

MERCURY CONTAMINATION: During the heat treating process, testing and inspections, the product did not come in direct contact with mercury or any of its compounds nor with any mercury containing device.



Heat Treating and Metallurgical Consulting

METLAB
1000 E. MERMAID LANE
WYNDMOOR, PA 19038

Packing List

Sales Order Number:

100948

Sales Order Date:

Jun 7, 2018

Voice: 215-233-2600

Fax: 215-233-5653

Page:

1

Sold To:

DART AEROSPACE
1270 ABERDEEN STREET
HAWKESBURY, ON K6A 1K7
CANADA

Ship To:

DART AEROSPACE
1270 ABERDEEN STREET
HAWKESBURY, ON K6A 1K7
CANADA

Customer ID	PO Number	Payment Terms
DARA	PO040105	Net 30 Days
Ship Via	Process	
CALL CUSTOMER	HT	

Quantity	Item	Description	Total Shipped	This Shipment
30.00		30 PCS PART#: D350-748-241TRN CROSSTUBES HEAT TREAT TO MIN 180 KSI AS PER DWG D350-748-241 CHECK FOR STRAIGHTEN AND ENSURE PARTS ARE STRAIGHT WITHIN 1/8" AS PER DWG. SAND BLAST TUBE AFTER HEAT TREAT. 1310 POUNDS		
1.00	CERT.			

COMMENTS

SHIPPED BY, SIGNATURE
METLAB

DATE

RECEIVED BY, SIGNATURE
DART AEROSPACE

DATE